EECS 306 : Signals and Systems II

Credits: 4 credits
Term offered: I, II
Prerequisites: EECS 206, 215 and Math 216. Can not receive credit for EECS 212/316 and 306.

Description: Theory and practice of signals and systems engineering in continuous and discrete time. Hands-on experience in laboratory sessions with communications, control and signal processing. Continuous-time linear systems: convolution, Fourier and Laplace transforms, transfer functions, poles and zeros, stability, sampling, introductions to communications and feedback control. Discrete-time linear systems: Z transform, filters, Fourier transform, signal processing. State space models of systems using finite-state machines.

EECS 401 : Probabilistic Methods in Engineering

Credits: 4 credits
Term offered: I, II
Prerequisites: EECS 206, 212 or 316 and junior standing.

Description: Basic concepts of probability theory. Random variables: discrete, continuous, and conditional probability distributions; averages; independence. Introduction to discrete and continuous random processes: wide sense stationarity, correlation, spectral density.

Probability and random processes

Use probability models of the signal value distribution to predict performance of various systems. Design based on analytically predicted performance rather than by trial and error based on empirical measurements.

Data compression: Use a probability model for the signal value distribution of the data to be compressed to predict the mean squared error of the decoded reproduction, and to design based on analytical predictions.

Communications: In digital transmission, use probability models for the noise that causes errors, and to predict the frequency of errors. In analog communications, use probability model to predict the mean squared error that results from the noise. Design based on analytical predictions rather than empirical measurements.

Classification: Use probability models to predict the confusion matrix or the ROC curve, and to design based on analytical predictions rather than empirical measurements.

The course is a prerequisite for EECS 455, the digital communications course.

EECS 353 : Introduction to Communications Systems

Credits: 4 credits
Term offered: II
Prerequisites: EECS 212 or 316.

Description: Mathematical analysis of signals and signal processing used in analog and digital communication systems; sampling; quantization; pulse transmission; intersymbol interference; Nyquist criterion; partial response signals; eye diagrams; equalization; mixing; analog modulation and demodulation; receiver architectures; phase-locked loops; signal-to-noise ratio analysis; digital modulation and demodulation; spread spectrum communications.

EECS 455 : Digital Communication Signals and Systems

Credits: 3 credits
Term offered: I
Prerequisites: EECS 212 or 316, EECS 401.

Description: Digital transmission techniques in data communications, with application to computer and space communications; design and detection of digital signals for low error rate; forward and feedback transmission techniques; matched filters; modems, block and convolutional coding; Viterbi decoding.

i.e. digital modem and coder design

EECS 451 : Digital Signal Processing and Analysis

Credits: 4 credits
Term offered: I, II, IIIa
Prerequisites: EECS 212, 306 or 316.

Description: Introduction to digital signal processing of continuous and discrete signals. The family of Fourier Transforms including the Discrete Fourier Transform (DFT). Development of the Fast Fourier Transform (FFT). Signal sampling and reconstruction. Design and analysis of digital filters. Correlation and spectral estimation. Laboratory experiences exercise and illustrate the concepts presented.

EECS 452 : Digital Signal Processing Design Laboratory

Credits: 4 credits
Term offered: I, II
Prerequisites: preceded or accompanied by EECS 451.
There is a class webpage.

Description: Architectural features of single-chip DSP processors are introduced in lecture. Laboratory exercises using two different state-of-the-art fixed-point processors include sampling, A/D and D/A conversion, digital wave form generators, real-time FIR and IIR fi lter implementations. The central component of this course is a 12-week team project in real-time DSP Design (including software and hardware development).

EECS 452 is a senior/graduate design course whose main focus is the application of real-time digital signal processing (including theory, software and hardware) to a multi-week team project. This course satisfies the CoE's major design experience requirement.

The course consists of lectures, structured laboratory exercises, and team projects. The lectures and structured laboratory exercises are intended to provide a foundation for the team projects to build on. The lectures and structured laboratory exercises cover: architectural features of DSP processors (arithmetic, memory organization, pipe lining, and use of special on-chip hardware), amplitude quantization effects (in A/D and D/A conversion, waveform generation and digital filter implementation), special on-chip hardware (serial ports, host ports, and timers), programming of DSP processors, design and implementation of FIR and IIR filters, FFT usage, real-time concepts (interrupts, critical sections, threads of execution, etc.).

EECS 460 : Control Systems Analysis and Design

Credits: 3 credits
Term offered: I
Prerequisites: EECS 212 or 316.

Description: Basic techniques for analysis and design of controllers applicable in any industry (e.g. automotive, aerospace, semiconductor, bioengineering, power, etc.) are discussed. Both time- and frequency-domain methods are covered. Root locus, Nyquist stability criterion, and Bode plot-based techniques are used as tools for analysis and design.

EECS 498: Special Topics in Embedded Control Systems
Fall 2001

May become a regular course
Prerequisite: EECS 373
There is a class webpage

TOPICS

1. What is an Embedded System?
2. Interfacing a Microprocessor to the Analog World
3. Position and Velocity Measurements
4. The World of Sensors
5. Actuators
6. Motor Control
7. Feedback Systems
8. Haptic Interfaces and Virtual Environments
    Tutorial on Virtual Environments

LABS

1. Familiarization and Digital I/O
    Motorola MPC555 Header files
    Axiom Board Linker File
2. Quadrature Decoding Using the Time Processor Unit
    FQD Function Prototypes
    Motorola Semiconductor Programming Note on the FQD TPU Function
3. Queued Analog to Digital Conversion
    QADC Function Prototypes
4. Pulse Width Modulation
5. Frequency Analysis of PWM Signals
    Lab 5 Configuration Files
6. Introduction to Haptic Worlds
7. Controller Area Networking
    TouCAN driver
8. Introduction to OSEKWorks